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FEDERAL COMMUNICATIONS COMMISSION
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BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON D. C. 20554

In the Matter of	)	
	)	
	)	
Amendment of Parts 15 and 90	)	
of the Commission's Rules to	)	ET Docket No. 93-235
Provide Additional Frequencies	)	RM-8094
for Cordless Telephones	)	

To: The Commission

REPLY COMMENTS OF THE TIA MOBILE & PERSONAL COMMUNICATIONS CONSUMER RADIO SECTION

SUMMARY

The Telecommunications Industry Association Mobile & Personal Communications Consumer Radio Section ("the Section") hereby offers its Reply Comments on the Notice of Proposed Rule Making ("NPRM") adopted by the Commission in the above-captioned matter. In that NPRM, the Commission proposes to make available for cordless telephones 15 new frequency pairs near 44 and 49 MHz, to be shared on a secondary basis with the existing Private Land Mobile Radio Service ("PLMRS") users.

The Section has reviewed the fifteen sets of Comments submitted to the Commission in this proceeding, and has found that the majority support the proposal in the NPRM. Opposition to the NPRM seems to be based on two primary concerns: (1) possible interaction between cordless telephones using the new frequencies and the Private Land Mobile Radio Service, and (2) the potential for interference from the proposed 43/44 MHz frequencies into the intermediate frequency ("IF") passband of TV receivers.

The American Petroleum Institute ("API"), Forest Industries Telecommunications ("FIT"), and the Utilities Telecommunications Council ("UTC") express concerns that cordless telephones will interfere with the PLMRS communications of their

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members. However, none of these three parties has provided any quantitative evidence whatsoever to support their contentions. Their concerns seem to be based on a superficial assessment of the situation and a lack of understanding of the technical details related to the potential for interaction between cordless telephones and the PLMRS operations of their members. Nevertheless, because of the importance of the PLMRS usage discussed by API, FIT, and UTC, the Section has carefully considered their concerns, and investigated received field strength levels due to cordless telephones as well as ambient radio noise. The Section concludes that a PLMRS system designed to be reliable in the presence of ambient background noise (*e.g.*, noise from vehicle ignition systems) should not be adversely affected by cordless telephones. Further, the large difference in transmitted power between cordless telephones and PLMRS transceivers renders the interference scenarios postulated by API implausible.

API, FIT, and UTC also express concerns about interference from PLMRS operations to cordless telephones. The scenario of concern is one in which the cordless telephone establishes a link on a frequency identified as "clear," but is subsequently used by a high-powered PLMRS transmitter, causing interference to the cordless telephone user. The Section believes that such incidents will be rare, but when they do occur, the frequency agility of the cordless telephones, coupled with the short, intermittent nature of PLMRS transmissions, will allow the cordless telephone user to quickly vacate the affected channel in favor of one that is clear. Moreover, as primary users of the frequencies, PLMRS operators need not be concerned about such interference even if it does occur, since the cordless telephone user has only secondary status and must accept the interference without complaint. Accordingly, the Section believes that interference from PLMRS operations to cordless telephones is not an issue in this proceeding.

The Association for Maximum Service Television, Inc. commenting jointly with the Public Broadcasting Service, and Zenith Electronics Corporation oppose the NPRM on the grounds that the proposed frequencies near 43 and 44 MHz will interfere with the 41-47 MHz IF (intermediate frequency) passband of TV receivers. Their opposition, however, suffers from the same defect as that of API, FIT, and UTC; it is merely speculative and unsupported by any experimental results or quantitative analysis. In contrast, Thomson Consumer Electronics, Inc. ("Thomson"), a manufacturer of both cordless telephones and TV sets, reports on results of tests it has conducted to investigate the possibility of this problem. Thomson concludes that the interference will occur only when the cordless telephone base unit is very close to the

TV set, and adequate protection can be provided by a cautionary note to the customer explaining the possible need to move the cordless telephone base unit away from the TV. This same position is taken by the Electronic Industries Association Consumer Electronics Group, which represents many TV manufacturers.

After reviewing the Comments filed in this proceeding, and addressing the issues raised in opposition to the NPRM, the Section continues to believe that the proposal in the NPRM is sound and in the public interest, and urges the Commission to proceed expeditiously to adopt it.

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To: The Commission

REPLY COMMENTS

1. The Telecommunications Industry Association ("TIA") Mobile & Personal Communications Consumer Radio Section ("the Section") hereby offers its Reply Comments on the Notice of Proposed Rule Making ("NPRM")[1] adopted by the Commission in the above-captioned matter. In that NPRM, the Commission proposes to make available for cordless telephones 15 new frequency pairs near 44 and 49 MHz, to be shared on a secondary basis with the existing Private Land Mobile Radio Service ("PLMRS") users.

2. To the Section's knowledge, a total of fifteen sets of Comments have been filed on the NPRM: the American Petroleum Institute ("API"), the American Radio Relay League, Inc. ("ARRL"), the American Telephone and Telegraph Company ("AT&T"), the Association for Maximum Service Television, Inc. ("MSTV") filing jointly with the Public Broadcasting Service ("PBS"), Cobra Electronics ("Cobra"), the Consumer Electronics Group of the Electronics Industries Association ("EIA"),

1. FCC 93-422, adopted August 20, 1993, Released September 17, 1993.

Forest Industries Telecommunications ("FIT"), the North American Foreign Trading Corporation ("NAFTC"), Tandy Corporation/Radio Shack ("Radio Shack"), John C. Thomas, Thomson Consumer Electronics, Inc. ("Thomson"), Uniden America Corporation ("Uniden"), the Utilities Telecommunications Council ("UTC"), Zenith Electronics Corporation ("Zenith"), and the Section itself. The major points raised in these Comments can be grouped into five broad categories: (1) support for the NPRM (AT&T, Cobra, EIA, NAFTC, Radio Shack, Thomson, Uniden, and the Section); (2) concerns about interference from cordless telephones to PLMRS (API, FIT, John C. Thomas, and UTC); (3) concerns about interference to cordless from licensed services (API, ARRL, FIT, John C. Thomas, and UTC); (4) the potential for interference from cordless telephone base stations using the 43/44 MHz frequencies to the IF (intermediate frequency) of TV receivers (EIA, MSTV/PBS, Thomson, and Zenith); and (5) questions about the need for the additional cordless telephone frequencies proposed in the NPRM (API, FIT, and UTC).

3. The Section is encouraged by the support expressed for the NPRM by the majority of commenting parties, some of whom are members of the Section (AT&T, Cobra, Thomson, and Uniden), and interprets this broad support as an affirmation of the need identified in the NPRM for more cordless telephone channels near the existing 46/49 MHz frequencies. Since the Section is in agreement with these supporting parties, it will concentrate in these Reply Comments on the reservations expressed by several parties about the proposal in the NPRM.

I. CORDLESS TELEPHONES WILL NOT CAUSE HARMFUL INTEFERENCE TO PROPERLY DESIGNED PLMRS SYSTEMS

4. The PLMRS frequencies proposed in the NPRM for secondary use by cordless telephones are licensed to the Petroleum Radio Service ("PRS"), the Forest Products Radio Service ("FPRS"), and to radio communications associated with utilities (*i.e.*, electricity, gas, water, steam, and natural gas pipelines). API, FIT, and UTC express concerns about the potential for interference from cordless telephones to these PLMRS users.

5. API, FIT, and UTC describe the uses of the frequencies by the PRS, FPRS, and utilities, and emphasize the importance of reliable radio communication in the businesses of their members.[2] They suggest that the sharing of these frequencies with cordless telephones will jeopardize the reliability of PLMRS operations on these frequencies. The Section does not dispute, nor wish to minimize, the importance of radio communications used for Petroleum, Forestry, and utility operations. However, it is apparent that neither API, FIT, nor UTC have seriously investigated the potential for interference from cordless telephones to the PLMRS. They offer no analyses or data to support their claims that cordless telephones operating under the Rules proposed in the NPRM *actually* pose a threat to the PLMRS. Rather, they simply assume that interference will be a problem and resort to postulating vague interference scenarios and summarily concluding that cordless telephones will seriously damage the PLMRS. The Section believes that any valid assessment of the interference potential requires a solid quantitative foundation, and therefore establishes such a foundation herein, and then, in light of it, addresses the concerns raised by API, FIT, and UTC.

A. AMBIENT NOISE LEVELS CAN EXCEED INTERFERENCE TO PLMRS MOBILE RECEIVERS FROM EVEN NEARBY CORDLESS TELEPHONES

6. The Commission's Rules (§15.233) limit the electric field (E-field) strength radiated by cordless telephones to 10,000 μV/m measured 3 meters from the transmit antenna in the direction of maximum radiation. Given that limit, Fig. 1 shows the variation of the E-field with distance for an open area (*i.e.*, a flat unobstructed test range, which typically is used to qualify cordless telephone designs). The E-field is shown in decibels relative to 1 μV/m (dBμV/m) for a frequency of 49 MHz and vertical polarization. The parameters σ and ε_R (assumed 0.01 mho/m and 20) are the the conductivity and relative dielectric constant of the earth, respectively. This curve was computed using the accepted model for propagation over a smooth earth.[3] It is consistent with various sets of measurements which have been made on open field sites.

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2. *See*, for example, API at pars. 2-5, FIT at p. 2, UTC at p. 2.
3. For background *see* E. C. Jordan and K. G. Balmain, *Electromagnetic Waves and Radiating Systems*, Second Edition, Prentice-Hall, 1968, Chapter 16.

7. In a typical cordless telephone usage situation, the propagation path is obstructed by various structures and objects, including building walls, so the propagation path is normally much less benign than that of an open field, and the path loss can be substantially greater than suggested by Fig. 1. For example, the path loss between a transmitter inside a building and a receiver outside is due not only to their separation, but also to the actual penetration loss through the building walls as well as losses associated with diffraction through openings such as windows, and reflections. The resulting "building loss" or "building attenuation" depends on the building configuration and materials, and also on frequency. In general, the building loss decreases as frequency increases.[4]

8. Of primary interest here is the attenuation of a 49 MHz signal due to typical residential structures. Smith[5] gives data for the attenuation due to various types of buildings, across a range of frequencies, including two single-family, wood-frame houses and two single-story concrete block buildings. These data suggest that at 49 MHz, the E-field attenuation is in the range of 10 to 20 dB for these four structures. The data of Rice[6] suggest that the median loss at 49 MHz will be somewhat higher than this for multi-story, steel-reinforced concrete structures such as office and apartment buildings typically found in urban areas.[7]

9. A building attenuation of 10 to 20 dB seems consistent with isolated comparisons by Section members of cordless telephone operating distances in open fields vs. "real world" environments. On an open field test site that is fairly "quiet" electromagnetically, a cordless telephone normally achieves an operating range of about 1000 feet, which corresponds to a received E-field strength of about 18 dBμV/m from Fig. 1. With the base unit inside a house and the handset outside, the operating range typically is on the order of 300 feet, which from Fig. 1 is consistent with an

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4. For example, *see* J. D. Parsons, *The Mobile Radio Propagation Channel*, Wiley, 1992, Chapter 7, and L. P. Rice, "Radio Transmission into Buildings at 35 and 150 mc," *BSTJ*, vol. 38, no. 1, pp. 197-210, January, 1959.
5. A. A. Smith, "Attenuation of Electric and Magnetic Fields by Buildings," *IEEE Transactions on Electromagnetic Compatibility*, vol. EMC-20, no. 3, pp. 411-418, August, 1978.
6. L. P. Rice, *op. cit.*.
7. For 35 MHz and 150 MHz, Rice found the overall average building loss to be 24 dB and 22 dB, respectively.

effective loss due to the house structure and other "clutter" of about 20 dB.[8]

10. To illustrate the effect of the building loss on the ambient E-field outside the house due to the cordless telephone, Fig. 2 shows an idealized curve of the field strength for a signal that propagates according to the "smooth earth" model, except that it suffers a one-time 15 dB loss due to a wall about 30 feet from the transmitter. Once through the wall, it continues to propagate in accordance with the smooth earth model. This model is admittedly simplistic (for example, it does not account for multipath) and may be too optimistic for many cases, but will serve adequately for the present purpose.

11. Fig. 3 shows the strength of typical man-made ambient radio noise as a function of frequency for urban and suburban environments.[9] The factor F_a represents the ambient noise level in dB above thermal noise (kT_0B, where k is Boltzman's constant, T_0 is the standard reference temperature, normally taken as 290° Kelvin, and B is the channel bandwidth). The corresponding rms field strength of the noise may be calculated using the formula:[10]

$$E(\mathrm{dB}\mu\mathrm{V/m}) = F_a + 20\log f(\mathrm{MHz}) + 10\log B(\mathrm{kHz}) - 65.5.$$

For a frequency of 49 MHz and a bandwidth of 20 kHz, this relationship becomes $E(\mathrm{dB}\mu\mathrm{V/m}) = F_a - 18.7$.

12. For a 49 MHz signal, Fig. 3 shows that F_a is roughly 32 dB and 46 dB for the suburban and urban environments, respectively. From the formula, these correspond to field strengths of about 13.3 and 27.3 dBμV/m for suburban and urban environments, respectively, assuming a 20 kHz channel bandwidth. In the case of a PLMRS mobile receiver, the effective noise floor may be even higher than typical

8. The operating range outside a house will vary somewhat, depending on such factors as whether the house has aluminum siding and foil-backed exterior wall insulation.

9. Fig. 3 is reproduced from *Reference Data for Radio Engineers,* Sixth Ed., Howard W. Sams & Co., 1981, p. 29-2, Fig. 1.

10. *Id.*, p. 29-3.

ambient levels, due to the ignition noise of the vehicle itself. Fig. 4[11] shows the distribution of F_a at 48 MHz from a sample set of 958 vehicles, measured 50 feet from the vehicle. As shown on the curve, the mean is 20.2 dB and the standard deviation is 10.8 dB. Since the antenna will normally be much closer to the engine than 50 feet, the received noise levels will be correspondingly higher. For example, if the antenna is 5 feet from the engine, then the curve would translate upward by 20 dB, the mean would be 40.2 dB, and the fifth percentile would be about 60 dB (the standard deviation would remain unchanged). Hence, the received noise could be significantly higher even than the urban ambient level; (*e.g.*, field strength at the fifth percentile would be about 41 dBμV/m[12]).

13. Further, the digital devices present in virtually all electronic gear today, including radio receivers and microprocessor-controlled automotive electronics systems, can radiate fields up to 100 μV/m (40 dBμV/m) at 3 meters by §15.109 of the Commission's Rules. Hence, from Fig. 2, the field strength received from a cordless telephone 100 feet from the house is the same as the level allowed 3 meters (about 10 feet) away from any unintentional radiator, including Class B (residential) digital devices, under §15.109. It should be noted that Class A (commercial) digital devices are allowed to radiate 90 μV/m at 10 meters, which translates to 300 μV/m at 3 meters, or about 9.5 dB higher than other unintentional radiators. Moreover, under §15.103(a), digital devices used exclusively in motor vehicles are exempted altogether from these limits. Hence, it is conceivable that a PLMRS receive antenna can be subject to noise levels exceeding 40 dBμV/m due to digital devices and other unintentional radiators on board the vehicle.

14. Even from this small set of examples, two things are clear regarding the noise impacting a PLMRS receiver: (1) in some cases, the levels incident on a PLMRS mobile antenna can be quite high, sometimes exceeding 40 dBμV/m, and (2) the actual level in a given situation exhibits a large statistical variability. However, this sort of variability is characteristic of radio communication in general, not only because

11. Reproduced from Fig. B6 of A. D. Spaulding and R. T. Disney, "Man-Made Radio Noise, Part I: Estimates for Business, Residential, and Rural Areas," OT Report 74-38, Office of Telecommunications, U. S. Department of Commerce.

12. This means that there is a 5% probability that the field strength exceeds 41 dBμV/m.

of variations in noise and interference, but also due to the statistical uncertainties associated with the propagation of the desired signal. This variability must be taken into account during the design of any radio communication system. The greater the reliability requirement of the system, the more margin must be added to the link budget to account for the statistical variation in received signal strength and noise. If, as claimed by API, FIT, and UTC, reliability is critical for the communications carried out via the PLMRS frequencies,[13] then it seems reasonable to assume that the systems are designed with adequate margin to ensure clear communication (with perhaps 98% or 99% reliability) even in the presence of highly variable path loss and noise levels. For example, if vehicle noise is the dominant source of interference and the system is designed to be 99% reliable, then Fig. 4 (with the assumption that the antenna is 5 feet away from the engine) suggests that the signal levels within the coverage area must be sufficiently strong to overcome a noise field strength of about 45 dBμV/m, or roughly 175 μV/m. From Fig. 2, this corresponds to the field strength about 70 feet from the house; *i.e.*, on the street adjacent to the house.

15. It might be argued that in many instances, the noise levels will be relatively low (for example, the engine in the vehicle may be off). The point, however, is that for reliable communication, a PLMRS system must be designed for worst-case conditions, including high noise levels. Coverage contours must be computed with enough margin in the link budget to overcome any reasonable impairments, which for vehicular communications, certainly must include high levels of ignition noise. If this is the case, and the cordless telephone signal is roughly equivalent to the worst-case noise (*i.e.*, the 1% or 5% point on Fig. 4), then communication over the PLMRS system should be possible even at the edge of the nominal coverage area in the presence of the cordless telephone signal. Thus, a properly designed PLMRS system should experience no harmful interference from cordless telephones using the proposed new frequencies.

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13. API at par. 2, FIT at pp. 2-3, UTC at p. 2.

B. MOBILE AND MOMENTARILY INACTIVE PLMRS TRANSMITTERS WILL NOT SUFFER HARMFUL INTERFERENCE FROM CORDLESS TELEPHONES

16. API and FIT contend that the automatic channel selection requirement proposed in the NPRM will not be adequate to ensure that a cordless telephone does not interfere with PRS and FPRS operations.[14] One concern seems to be that a cordless telephone will identify a frequency as "clear" and begin using it for communication, generating interference to a subsequent use of the frequency by a PLMRS transceiver that is mobile and approaching the vicinity of the cordless telephone, or previously was inactive. This scenario is implausible because of the large difference in transmitted power between the cordless telephone and the PLMRS user. As noted in the NPRM, the cordless telephone transmits about 25 microwatts, while the PLMRS unit can transmit 100-300 watts.[15] Even for a PLMRS mobile unit transmitting 25 watts, the PLMRS transmit power exceeds that of the cordless telephone by 60 dB (a power ratio of one million to one). This means that the cordless telephone will sense the presence of an approaching mobile transmitter, even if it is intermittently active, well before the vehicle is near enough to the cordless telephone to receive a signal from the cordless that even equals the ambient noise floor. Moreover, as noted above, for a PLRMS system engineered for high reliability, a dispatch signal from the base unit should overcome the cordless telephone signal even if the vehicle's transmitter is inactive and the cordless telephone remains on the channel.

17. A related concern expressed by API is that:

> if a land mobile system's transmitter is momentarily quiescent, the monitoring device [in the cordless telephone] will not consider the channel occupied and thus [will] establish a link. Seconds later the attempted transmission of a critical message or an automatic alarm signal could essentially destroy the telephone conversation <u>or</u> the reliability of the private land mobile transmission could be compromised.[16]

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14. *See* API at pars. 6-8 and FIT at p. 5.
15. *See* FIT at p. 5 and NPRM, p. 2, footnote 9.
16. API at par. 8 (emphasis in original).

This situation also seems implausible. If the cordless telephone is within reception range of a PLMRS base station serving many mobiles on the frequency of concern, it will regularly receive signals on that frequency and will avoid using it. If the cordless telephone is unable to detect signals from the base station, then it will in all likelihood be outside the coverage area of the PLMRS base station. In the unlikely event that a PLMRS mobile is parked with its engine off directly outside a house in which a cordless telephone is active on the frequency of interest, AND cordless telephone signal is above the squelch threshold of the receiver, the operator would hear the transmitted signal from the handset. The natural reaction in this unlikely situation would be for the operator to key the microphone and inform the cordless telephone user that they are transmitting on a frequency used by a licensed service, at which point the cordless telephone user would need to vacate the frequency to continue the conversation.[17]

C. CONCERNS ABOUT REPEATER SEIZURE BY CORDLESS TELEPHONES ARE UNFOUNDED

18. API also states that:

> during emergencies, as well as regular operations, it is not desirable to have cordless phones operating on the same frequencies as land mobile operations because of the threat of audible and sub-audible tones. Should cordless telephones emit these tones on land mobile frequency assignments, they could access relatively high power (300 watts) mobile relay transmitters operated by PRS licensees using channels in this band.[18]

Although this hypothesis is vaguely stated, the Section assumes that API's reference to "audible and sub-audible tones" refers to the "guard tones" used by older 46/49 MHz units for control functions such as switchhook activation. API evidently is unaware

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17. Even though the transmission from the PLMRS mobile would be received by the base unit rather than the handset, it would be carried back to the handset via the sidetone path.

18. API at par. 11. The Section is somewhat puzzled that a communication system for which high reliability is required might be so vulnerable to random audio tones transmitted on such a low-power carrier as a cordless telephone signal.

that for the last several years, cordless telephones have been required under §15.214 of the Commission's Rules to use digital security coding. Any new units manufactured to operate on the proposed new frequencies would be required to comply with §15.214 and hence would use digital security coding rather than audio guard tones.

19. Vulnerabilities of the activation mechanism notwithstanding, if such a high-power repeater were located near enough to residential areas for seizure by a cordless telephone to be possible, it would easily overpower all cordless telephones in the vicinity, and they would avoid the affected channel. The Section therefore believes that API's concerns about repeater seizure by cordless telephones are unfounded.

D. EFFECTIVENESS OF THE CHANNEL MONITORING MECHANISM IS ENHANCED BY THE SIMPLEX OPERATION OF PLMRS

20. API questions the effectiveness of the proposed automatic channel selection requirement proposed in the NPRM, stating that "the proposal fails to properly address the question of whether the monitoring to be undertaken will be conducted at both the base set and hand set or in only one of the units. This is very important because of the extensive use of simplex channels by private land mobile users. The simplex channels are not compatible with the duplex channel plan suggested by TIA."[19] In the related footnote,[20] API poses a series of questions about whether the base and handset transmitter and receiver will be monitored before establishing a link.

21. These statements and questions suggest that API has not carefully thought through potential cochannel interference scenarios. There are two key factors that must be understood to comprehend the operation of the proposed channel monitoring requirement. First, due to their very limited range, the cordless telephone base and handset will always be very close together (usually in the same house and within 50 to 100 feet of one another). Second, a PLMRS mobile may be many miles from the base transceiver or repeater with which it is directly communicating. Because of this second factor, the fact that PLMRS units operate in the simplex mode *greatly enhances* the effectiveness of the automatic channel monitoring requirement, because if a

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19. API at par. 12.
20. API, footnote 7, p. 11.

PLMRS mobile is near enough to a cordless telephone to receive a signal from it on a given frequency that is above the ambient noise floor of the PLMRS receiver, it will, due to its much greater transmit power, generate a signal on the same frequency of such strength in the cordless telephone's receiver that the cordless telephone will unambiguously recognize the channel as being "occupied." Therefore, even if the signal from a distant base station is relatively weak, use of the frequency by the cordless telephone will be prevented (or curtailed, if it is already in use).

22. Because of the close proximity of the cordless telephone base and handset, the field strength received by them from a PLMRS transmitter would have a comparable effect, even accounting for any building loss, whether that transmitter is nearby or distant. In the case of a nearby PLMRS transmitter, the interference power into both the base and the handset would be overwhelming, and either one would register the channel as "occupied." With a distant PLMRS transmitter, the difference in the respective distances from the PLMRS transmitter to the base and handset is negligible compared to the distances themselves, so again, the base and handset would be equally effective at performing the monitoring function.[21]

23. Therefore, the answer to the questions posed by API in its footnote 7 is that the base unit will monitor activity on its own 48/49 MHz receive frequencies, including those of concern to API. Because of the close proximity of the cordless handset to its base, and the simplex operation of the PLMRS transceivers, the handset will not be able to establish a link on a 48/49 MHz frequency in use by a PLMRS transceiver near enough to the handset to receive a signal from it that exceeds the noise floor.

24. UTC states that "If the cordless telephone transmitter drifts off-frequency, and even with the FCC's suggested attenuation requirements, the cordless telephone could cause interference up to one mile away."[22] The Section assumes that UTC is implying that the cordless telephone would establish a link on a "clear" frequency, then somehow drift to an adjacent frequency during the cordless telephone call, causing

21. It could be argued that the handset might be outside the house and thus have a better propagation path to the PLMRS transmitter. However, the superior antenna system of the base unit, and hence its greater receiver sensitivity, tends to compensate for this. In addition, the antennas of handsets not in use often are retracted, making them even less sensitive to field strength.

22. UTC at p. 4.

interference to that adjacent occupied frequency. There are two flaws in this supposition. First, the interference distance is greatly exaggerated, as shown above. Second, if such a large frequency drift did occur in the handset transmitter, the base would no longer be receiving the channel to which is was tuned, and communication would cease.

E. THE SIGNIFICANCE OF THE PLMRS FREQUENCY USAGE DATA PROVIDED BY API AND FIT IS UNCLEAR

25. Finally, both API and FIT provide some data regarding the usage of the affected frequencies by the PRS and FPRS, respectively. API cites several examples of heavy usage of 48.860 MHz,[26] and provides an extensive list in Exhibit I of licensees and their states of operation for the frequencies of interest.[27] However, these data do not show whether there are any local coverage areas in which a sizable fraction of the fifteen frequencies proposed for sharing in the NPRM is used. FIT lists the numbers of licensees and transmitters using the FPRS in a number of metropolitan areas.[28] Unfortunately, this list is not broken down according to frequency, so its significance is unclear.

26. Both API and FIT seem to have missed the point of the Commission's sharing proposal. In any given area, there may be one or several frequencies that are heavily used by PLMRS licensees and therefore are largely unavailable to cordless telephones. However, the availability of many other frequencies coupled with frequency-agile cordless telephone designs will allow cordless telephones to be flexible and unobtrusive sharing partners with the PLMRS, and to take advantage of the fact that different PLMRS frequencies are used in different locations. It also should be noted that heavy usage of a given frequency in a given area actually is beneficial to the effectiveness of the automatic channel selection mechanism proposed for cordless telephones, because the heavier the usage on a given frequency, the less likely it is that a cordless telephone will establish a link on that frequency.

26. API at par. 16.

27. Exhibit I was not included in the original filing, but was filed via an Erratum on December 15, 1993 and forwarded to all parties of record.

28. FIT at p. 4.

II. INTERFERENCE TO CORDLESS TELEPHONES FROM LICENSED SERVICES IS NOT AN ISSUE IN THIS PROCEEDING

27. API, FIT, and UTC express concerns about the possibility of interference from PLMRS users to cordless telephones.[29] While such interference might occur if the cordless telephone user is already communicating on a frequency previously identified as "clear" by the monitoring mechanism, it generally will be of a very temporary nature due to the frequency agility of the cordless telephone and the short, intermittent nature of PLMRS transmissions. Indeed, FIT describes such transmissions as "short dispatch messages" and "short rapid fire messages." [30] Once the cordless telephone receives the first short burst of interference, either the user will push the "channel change" button, or, if the cordless telephone is sufficiently sophisticated, it will recognize the interference and automatically find a clear channel. Moreover, the cordless telephone users will be operating on strictly a secondary basis under Part 15 of the Commission's Rules, and therefore cannot complain of interference sustained from the primary user. The manufacturer clearly has an incentive to design a unit as robust as possible. The Section consequently believes that, because of the secondary status of the proposed cordless telephone provisions, the short, intermittent nature of PLMRS transmissions, the frequency agility of the cordless telephones, and the secondary status of the cordless telephone, interference from PLMRS users to cordless telephones is not an issue in this proceeding.[31]

28. ARRL, while not opposing the NPRM, suggests several measures to help minimize the susceptibility of cordless telephones to interference from high-power signals in adjacent bands, such as the 50-54 MHz Amateur band, and to help in resolving disputes between cordless telephone users and amateur operators. The suggested measures include: (1) the issuance of a public notification by the Commission of the secondary status of cordless telephones, (2) labels on cordless telephones or their packaging regarding the interference susceptibility of the devices,

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29. *See* API at pars. 6-8, FIT at pp. 2 and 5, UTC at p. 4-5.

30. FIT at p. 3.

31. In any event, the burden is on the designers of cordless telephones, not PLMRS operators, to accommodate such interference. Products that do not meet this burden will be rejected in the marketplace and any potential for interference is thus self-correcting.

and (3) development of interference-rejection standards for cordless telephones. The Section appreciates these suggestions, but believes that a public notification would have little impact and is in fact unnecessary; the secondary status of cordless telephones is clearly spelled out in the Commission's Rules. Additionally, the Section is seriously considering initiating a standards-development effort for cordless telephones upon resolution of this proceeding. Standards could include guidelines for labels or warnings about interference in the customer instructions booklets accompanying cordless telephones.

III. A CAUTIONARY NOTE WILL PROVIDE ADEQUATE PROTECTION FROM INTERFERENCE WITH THE TV RECEIVER INTERMEDIATE FREQUENCY

29. MSTV/PBS and Zenith express concerns about the potential for interference from the proposed 43/44 MHz base transmit frequencies to the IF (intermediate frequency) passband (41-47 MHz) of TV receivers. The arguments of MSTV/PBS and Zenith suffer from the same flaw as those of API, FIT, and UTC: they are supported by no quantitative analysis or test results, but rather are limited to speculation. In contrast, Thomson, which manufactures both cordless telephones and TV sets, also is concerned about this possible interference problem, but as reported in its Comments, it has conducted interference tests, rather than simply condemning the Commission's proposal. These tests "show that this interference occurs only when the cordless phone is used in close proximity to the TV or VCR."[32] Thomson supports the Commission's proposal, and as a remedy for the potential interference problem states that: "Thomson therefore supports the required inclusion of a cautionary note in the instruction manuals of cordless telephones."[33] Thomson proposes an example of such a note, but encourages the Commission to allow manufacturers some flexibility in the specific wording.

30. EIA, which represents manufacturers of consumer electronics equipment, including television sets, also addresses the potential for TV IF interference. EIA states that: "Tests conducted by an EIA/CEG [Consumer Electronics Group] member, at the suggestion of EIA's Video Systems Engineering Committee (R-4),

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32. Thomson at p. 2.
33. *Id.*

have revealed that the potential for interference is negligible, except where the cordless phone unit is quite close to the television set."[34] EIA goes on to support the proposal in the NPRM to restrict the 43/44 MHz frequencies to the base unit transmitter and, like Thomson, recommends a cautionary note to the user.

31. Based on the test results discussed by Thomson and EIA (both of whom have a strong interest in the quality of TV set performance), and the lack of any evidence offered by Zenith or MSTV/PBS to support their positions, the Section continues to believe that any interference that might be caused by the proposed new frequencies to the TV IF can be easily remedied by simply separating the base unit from the TV set, and that a cautionary note such as that suggested by Thomson and EIA will provide adequate protection against such interference.

IV. AVAILABILITY OF 900 MHZ AND 2 GHZ FREQUENCIES DOES NOT ELIMINATE THE NEED FOR NEW CORDLESS FREQUENCIES NEAR 49 MHZ

32. Several parties opposed to the NPRM question the need for the additional 44/49 MHz channels, citing the increasing availability of new Personal Communications Services ("PCS") and spectrum to support them.[35] It is true that the wireless personal communications industry is likely to experience explosive growth during the next decade. However, it also is true that as in any large consumer industry, there must be a broad range of choices available to the customer. Cordless telephones operating near 49 MHz represent a wireless technology that is affordable to practically anyone. This is not the case for any of the "alternatives" mentioned by API and FIT (cellular, the emerging 2 GHz PCS technologies, and 900 MHz cordless telephones). These alternatives involve higher frequencies and more complex air interfaces, and have correspondingly higher price tags. As noted in the NPRM, "While we believe that many consumers may eventually be attracted to alternative cordless telephone technologies and future personal communications services, it appears there will continue to be a demand for the current low-priced 46/49 MHz technology for the foreseeable future."[36] The proposal in the NPRM is designed to ensure that this low-

34. EIA at p. 2.
35. API at pars. 19-24, FIT at p. 5, UTC at p. 3.
36. NPRM at par. 8.

cost technology does not suffer premature obsolescence due to the lack of available spectrum. The Section, therefore, does not agree with the assessments of API, FIT, and UTC that the new frequencies are unnecessary due to the higher-priced alternative wireless solutions mentioned. The American public should have a choice of many products, including low-cost cordless telephones, to satisfy their communications needs.

V. CONCLUSION

33. The Section has reviewed the fifteen sets of Comments filed in response to the NPRM, and is pleased that the majority of these Comments support the Commission's proposal. Opposition to the NPRM seems to be based on two primary concerns: (1) interaction between cordless telephones using the new frequencies and the Private Land Mobile Radio Service, and (2) the potential for interference from the proposed 43/44 MHz frequencies into the IF passband of TV receivers.

34. API, FIT, and UTC have conveyed concerns about interference from cordless telephones to the PLMRS. While these Comments include absolutely no data, analysis, or experimental results to support their concerns, the Section has examined these concerns and addressed them in detail herein. The Section concludes that the fears of API, FIT, and UTC are unfounded, and seem to result from a superficial assessment of the situation and a lack of understanding about the technical aspects of the potential for interference between cordless telephones and PLRMS operations. The Section continues to believe that the large difference in the power levels transmitted by cordless telephones and PLMRS units, and the automatic channel monitoring mechanism proposed by the NPRM for cordless telephones, will protect PLMRS operations from harmful interference from cordless telephones. As shown herein, PLMRS mobiles typically will receive more interference from their own ignition systems than from cordless telephones.

35. API, FIT, and UTC also voice concerns about interference from PLMRS transmitters to cordless telephones. The NPRM is clear on the point that cordless telephones will share the proposed frequencies with PLMRS operations on a secondary basis, so the cordless telephone user must accept whatever interference occurs. The burden is on the designers of cordless telephones to minimize the disruptive effect of such interference to the cordless telephone user. In most cases, the automatic channel monitoring mechanism will protect cordless telephones from

such interference, preventing the cordless telephone for establishing a communication link on a frequency already in use by a PLMRS transmitter. However, even if the cordless telephone user is interrupted during a call by a high-power PLMRS transmission, that PLMRS transmission is typically very short and the cordless telephone user will have the option of moving to a clear channel. The Section, therefore, maintains that interference from PLMRS operations to cordless telephones is not an issue in this proceeding.

36. MSTV/PBS and Zenith oppose the NPRM on the grounds that the 43/44 MHz frequencies will interfere with the 41-47 MHz IF of TV sets. Like API, FIT, and UTC, however, they offer no analysis or test results to support these claims. Conversely, Thomson (which manufactures TV sets) and EIA (which represents a large number of TV set manufacturers) report on the results of interference tests and conclude that a cautionary note to the customer would provide adequate protection, when coupled with the requirement proposed in the NPRM that the 43/44 MHz frequencies be restricted to the cordless telephone base transmitter. The Section, therefore, believes that the risk of harmful interference to the TV IF is minimal, and can be addressed with the type of cautionary note proposed by Thomson and EIA.

37. In conclusion, the Section continues to support the proposal in the NPRM, with the addition of a requirement cautioning the consumer about the possible need to separate the base station from TV sets, and urges the Commission to act expeditiously to adopt the Rules proposed in the NPRM with this minor modification.

Respectfully submitted,

TELECOMMUNICATIONS INDUSTRY ASSOCIATION
MPC CONSUMER RADIO SECTION

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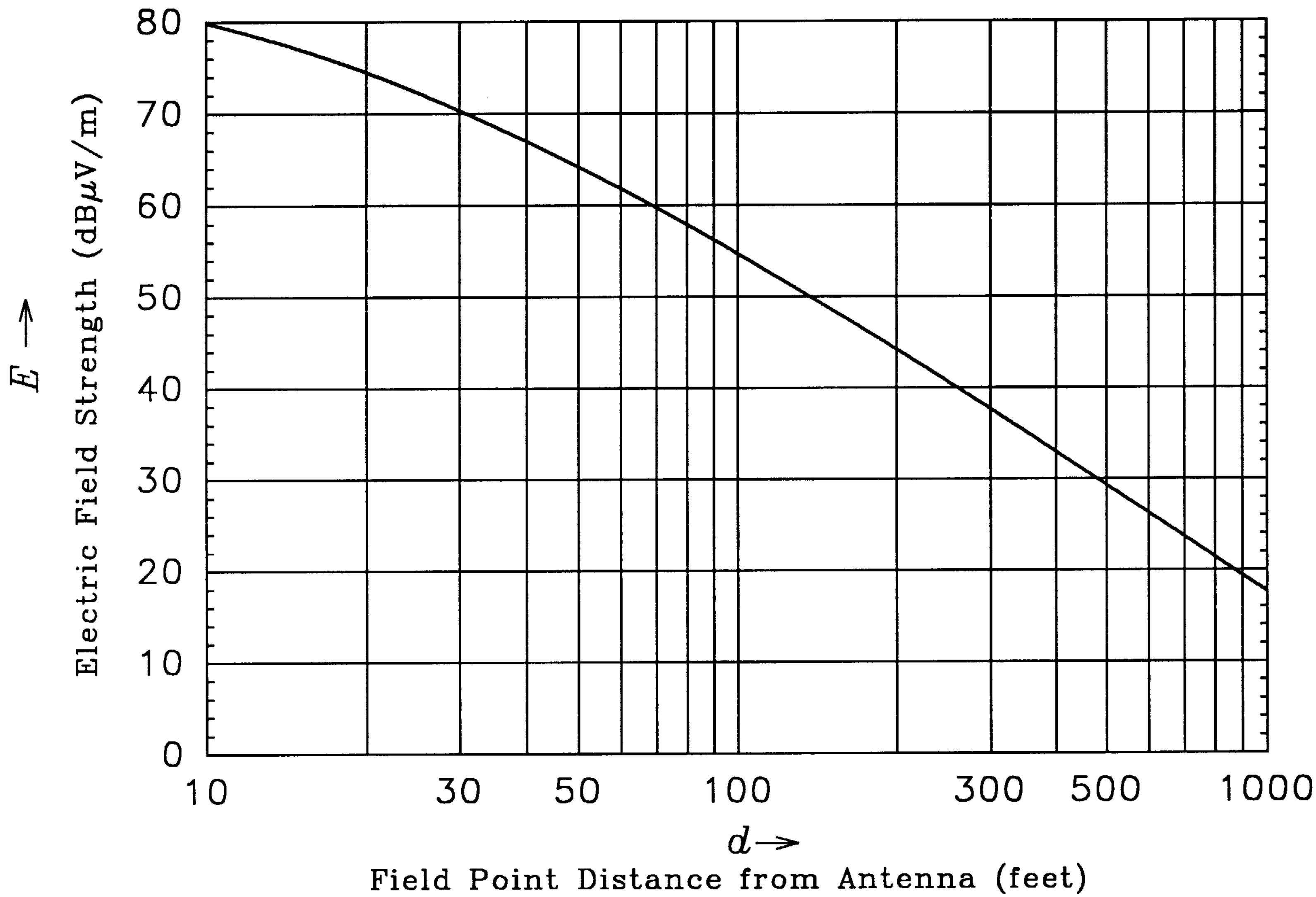

Fig. 1: Received field strength vs. distance for an open area at 49 MHz. Transmit antenna and field point are 5 feet above surface. Field strength at 3 meters (9.8 feet) is 10,000 μV/m; ϵ_R=20 and σ=0.01 mho/m. Assumes vertical polarization.

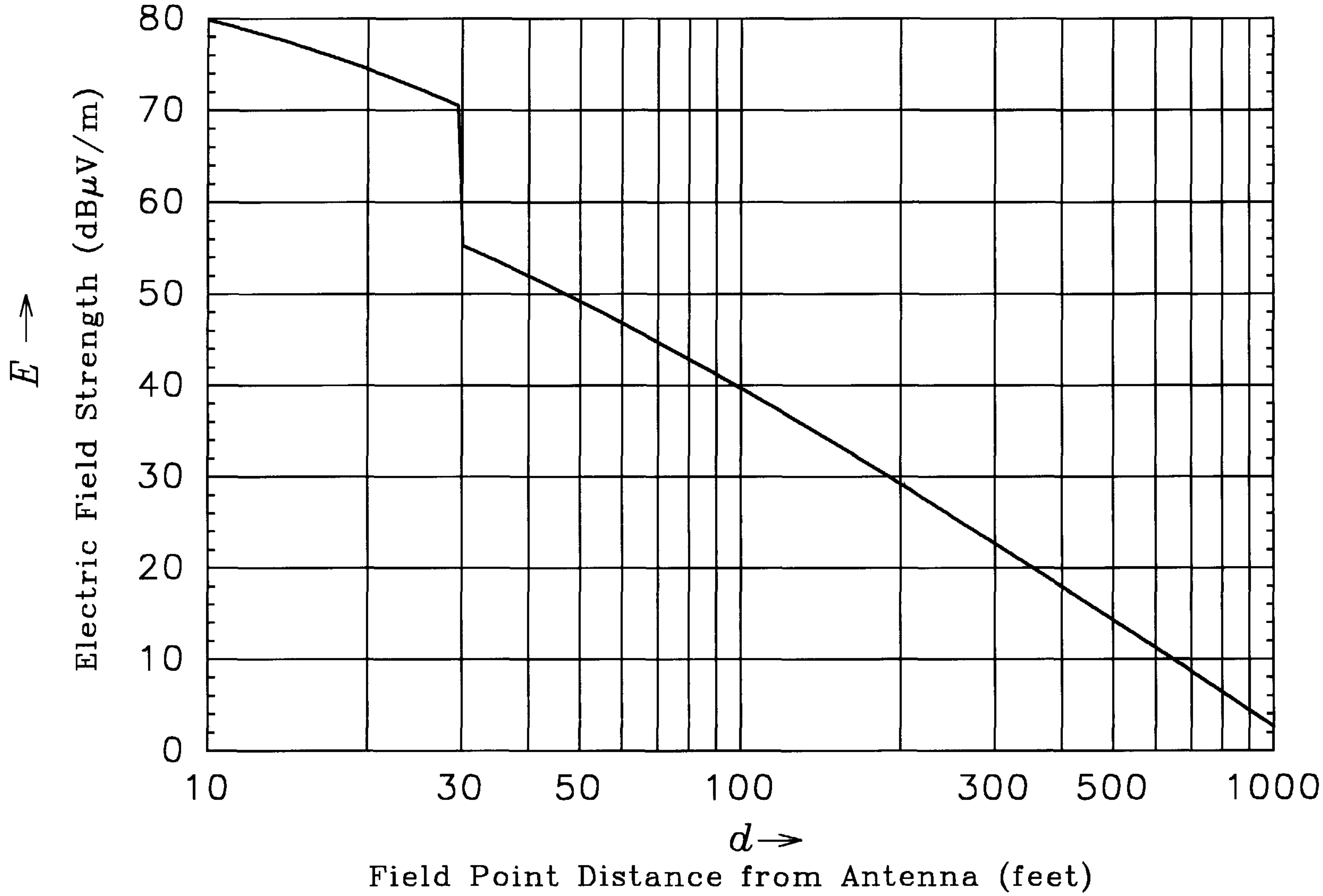

Fig. 2: Received field strength vs. distance for 49 MHz as in Figure 1, except a lumped attenuation of 15 dB was assumed 30 feet from the transmitter (an idealized model for the effect of building loss).

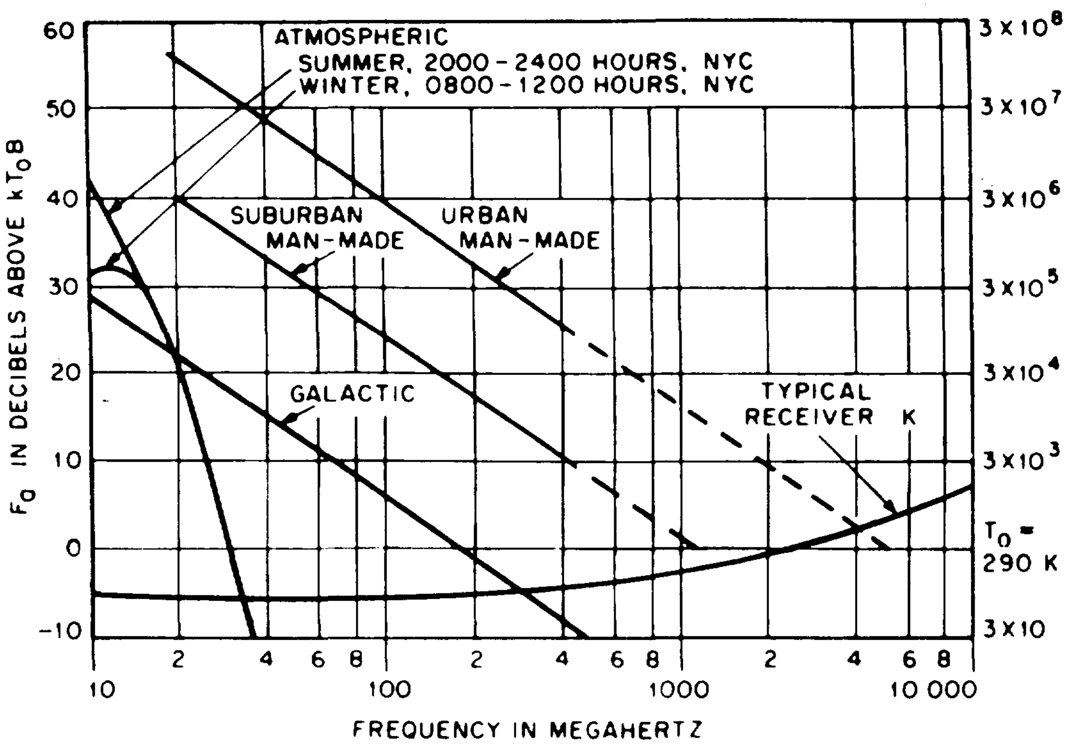

Figure 3: Median values of average noise power expected from various sources (omnidirectional antenna near surface). [Reproduced from Fig. 1, p. 29-2 of *Reference Data for Radio Engineers*, Sixth Ed., Howard W. Sams & Co., 1981.]

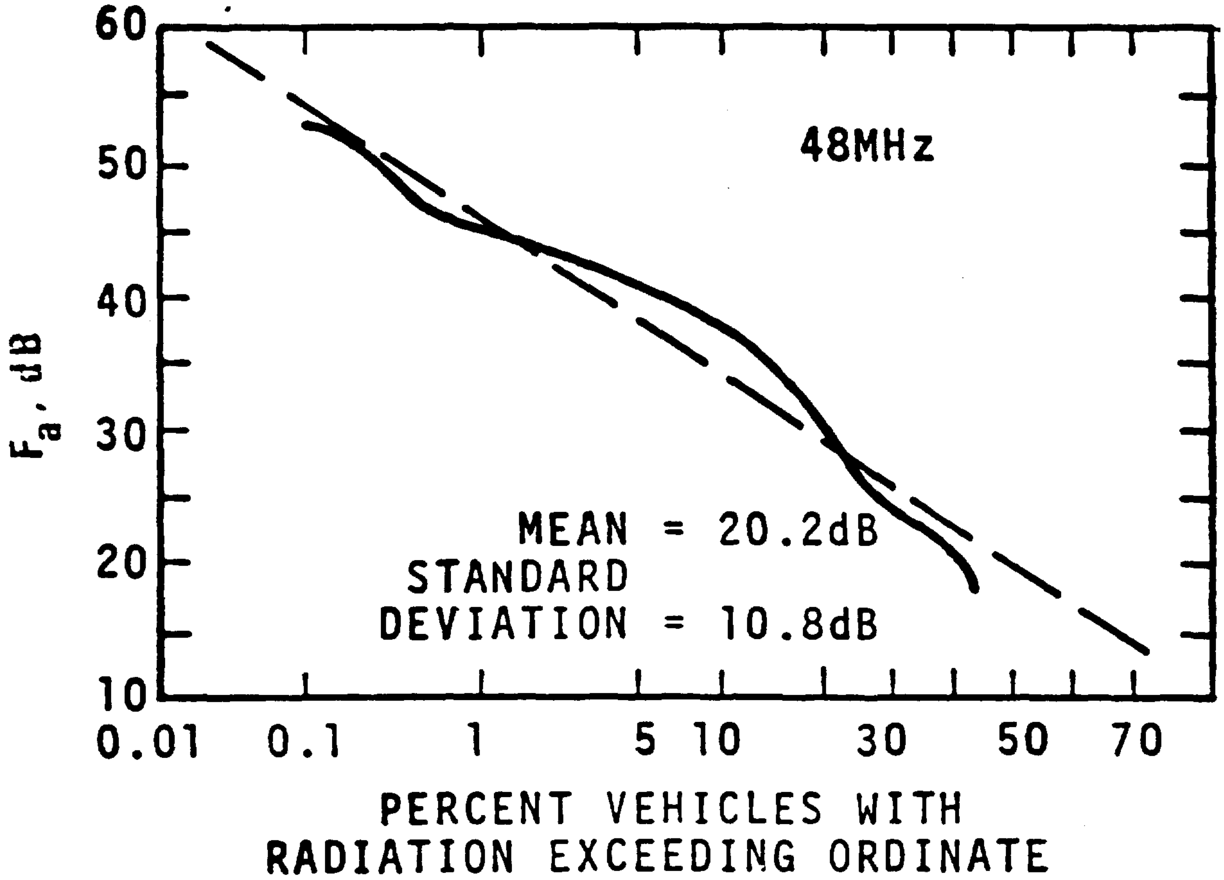

Figure 4: Distribution of radio noise power at 48 MHz radiated from 958 individual vehicles, values measured 50 ft from vehicle. [Reproduced from Fig. B6 of "Man-Made Radio Noise, Part I: Estimates for Business, Residential, and Rural Areas," OT Report 74-38, Office of Telecommunications, U. S. Department of Commerce.]

CERTIFICATE OF SERVICE

I, Eileen C. Mullen, hereby certify that pursuant to the requirements of 47 CFR 1.405 (b), copies of the foregoing Reply Comments of TIA have been served by U.S. First Class Mail to the Parties listed below.

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